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GEOLOGY OF THE ABBEVILLE-PERRY-SOUTH PERRY STRUCTURE, VERMILION PARISH, LOUISIANA

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ILLUSTRATIONS

I. ABSTRACT

The Abbeville-Perry-South Perry structure is located in the Miocene oil- and gas-producing trends of Vermilion Parish, Louisiana. The strata encountered by drilling are primarily Pliocene, Miocene, and Oligocene in age. Wells drilled to sufficient depth encounter three distinct facies: first, a shallow-water massive Pliocene and Miocene near-shore to continental sand facies; then, an intermediate facies of alternating sands and shales from the Miocene continental-shelf environment; and, finally, the thick deep-water shale facies of the early Miocene and late Oligocene.

Structurally, the Abbeville-Perry-South Perry feature is a faulted, elongate anticline that trends north-northwest. It is oriented normal to the regional strike of the beds. All faults are normal and include both down-to-

the-basin and up-to-the-basin faults. The former are generally regional in extent; the up-to-the-basin faults are smaller compensating faults confined to the Abbeville-Perry-South Perry structure. The fault throw generally increases gradually with depth. Faults decreasing with depth appear to "die-out" in the bathyal shales.

Individual beds thicken onto the downthrown sides of the faults and thin toward the crest of the structure. The amounts of thickening or thinning generally increase gradually with depth. Thus, fault movement and anticlinal folding were contemporaneous with sedimentation more-or-less continuously from Oligocene to Pliocene time. These tectonic movements were greatest during Oligocene and Lower Miocene time.

The Abbeville-Perry-South Perry structure probably originated from anticlinal folding and faulting in the region of the continental slope during early Miocene and Oligocene time. As the hinge line (or shelf edge) migrated seaward across the area, the structure became positioned closer to the shoreline until in Pliocene time it was near the shoreline. Anticlinal growth and fault movement were greatest at the time when the structure was located in the environment of the continental slope and outer continental shelf. The structural activity steadily decreased after Lower Miocene time as the hinge line with its unstable environment continued to migrate farther basinward.

II. Introduction

Abbeville field is located two to three miles west-northwest of the city of Abbeville in Township 12 South, Range 3 East, Vermilion Parish, Louisiana. The Perry and South Perry fields are located in Vermilion Parish, Louisiana, two to four miles south of the Abbeville field (see figure 1).

Abbeville was known to be a prospect as early as 1929, when reflection seismic surveys conducted by the Humble Oil and Refining Company and the Atlantic Oil Producing Company showed evidence of a structure in the area. The Stanolind Oil and Gas Company also surveyed the Abbeville area with the reflection seismograph in 1935. Both subsurface geology and geophysical exploration techniques were used in locating the Perry and South Perry fields. The discovery well for Abbeville field was the Continental No. 1 Hebert (sec. 20, T12S, R3E). In March, 1937, the well flowed 52 barrels of 41° API gravity oil and approximately 3 million cubic feet of gas per day through perforations at 7,666 feet to 7,682 feet. The confirmation well, the Continental No. 1 Brookshire (sec. 66, T12S, R3E) was completed in November, 1937. The initial production through perforations 7,884 feet to 7,890 feet was 514 barrels of 43.1° API gravity oil and 1,140,000 cubic feet of gas through a 3/16-inch choke with a tubing pressure of 2,150 pounds. In December, 1937, the discovery well was recompleted through perforations 7,886 feet to 7,892 feet. The well flowed 203 barrels of 41° API gravity oil and 243,000 cubic feet of gas. The total production for Abbeville field in 1937 was 17,185 barrels of oil and 157,-305,000 cubic feet of gas. This production came entirely from the Hebert No. 1 and Brookshire No. 1 wells.

One hundred and thirty-four tests have been drilled in Abbeville field since 1937. Sixty-seven of these are presently producing wells; sixty-seven were dry holes. The records of the Louisiana Geological Survey (at the end of 1963) list 44 oil wells and 23 gas wells for Abbeville field. It has been calculated that the producing wells were completed in 240 feet of net oil sand and 150 feet of net gas sand.

The discovery well for Perry field, the Texas Gas Exploration No. 1 Noel (sec. 5, T13S, R3E), was completed in 1957 as a gas well in 50 net feet of gas sand from 10,894 feet to 10,944 feet. The initial production through perforations 10,935 feet to 10,940 feet was 19 barrels of 49.9° API gravity oil per day, plus 2.6 million cubic feet of gas, on a 12/64-inch choke with a tubing pressure of 3985 pounds and a gas-oil ratio of 143,586:1. The Texas Gas Exploration No. 2 Noel (sec. 5, T13S, R3E), drilled as an eastern offset to the discovery well, was an attempt to confirm the Perry field. The test was dry and abandoned in December, 1957, with a total depth of 11,614 feet. The next well drilled was the Texas Gas Exploration No. 1 De Marcy (sec. 6, T13S, R3E). The test, located about ½ mile west of the discovery well, confirmed the Perry field with a completion in the same 50-foot gas sand encountered in the Noel No. 1. The top of this sand was encountered in the De Marcy well at 10,844 feet, 50 feet higher

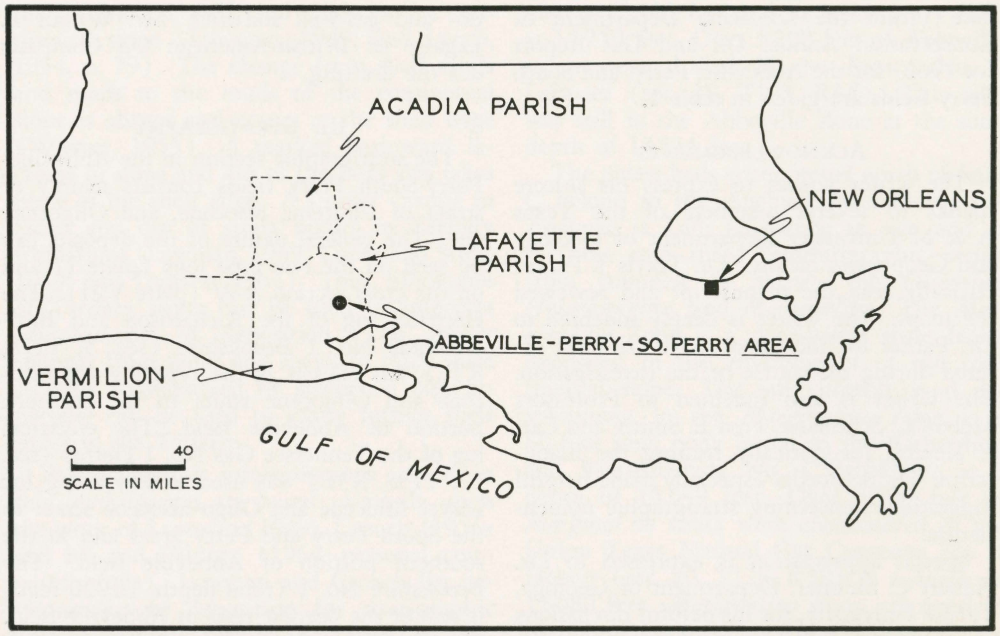

Figure 1. Map of South Louisiana showing the location of the Abbeville-Perry-South Perry structure.

than in the discovery well. The De Marcy No. 1 completion was followed by the drilling of three dry holes, two in 1958 and one in the early part of 1959. The total depths of these three dry holes were near 11,000 feet. Two other tests, the No.1 LeBouef (sec. 10, T13S, R3E), and No. 1 Champagne (sec. 3, T13S, R3E), drilled by the Hope National Gas Company, were drilled recently in Perry field. Both wells were completed in a 20-foot gas sand below 11,000 feet. By the end of 1963, eight tests had been drilled at Perry. Four of these are producing gas wells; the other four are dry holes. The producing wells were completed in approximately 70 feet of gas sand.

The discovery well for South Perry field was the Tennessee Gas No. 1 Detraz (sec. 17, T13S, R3E). The well was completed in 1960 as a gas-distillate discovery in 36 net feet of sand from 14,713 feet to 14,798 feet. The well flowed initially (through perforations at 14,717 feet to 14,732 feet) 185 barrels of 46.8° API gravity oil and 4,775,-000 cubic feet of gas through a 12/64-inch choke with a tubing pressure of 6100 pounds, and a gas-oil ratio of 25,810:1. The well also yielded 0.1 per cent basic sediment and water.

Six wells have been drilled at South Perry. All of these tests, except the Detraz No. 1, were found dry and abandoned. Two of the dry holes, the Phillips No. 1 Noel (sec. 9, T13S, R3S) and the Feazel No. 1 Mouton (sec. 15, T13S, R3E), were drilled several years prior to the completion of the Detraz No. 1. The discovery well is located ½ mile west of the Mouton test and ¾ mile southwest of the Noel No. 1. The Mouton No. 1 was drilled to a total depth of 11,520 feet; the Noel No. 1 to a total depth of 13,502 feet. The other dry holes in the South Perry area were drilled subsequent to the discovery well. The Sinclair No. 1 Mestepey (sec. 15, T13S, R3E), located ½ mile south of the Detraz No. 1, was found dry and abandoned in 1961 at a total depth of 15,455 feet. Another test, the Plymouth No. 1 Duhon (sec-7, T13S, R3E), drilled to a total depth of 12,700 feet, was also found dry and abandoned in 1961. The most recently drilled test in the area, the Vaughn No. 1 Dumond Heirs (sec. 8, T13S, R3E), was found dry and abandoned in 1962 at a total depth of 12,613 feet. The Duhon No. 1 and the Dumond Heirs No. 1 are to the northwest of the discovery well.

Total accumulated production figures todate (from the Louisiana Department of Conservation Annual Oil and Gas Report for 1962) for the Abbeville, Perry, and South Perry fields are given in table 1.

ACKNOWLEDGMENTS

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III. STRATIGRAPHY

The stratigraphic section in the Abbeville-Perry-South Perry fields consists mainly of strata of Pliocene, Miocene, and Oligocene age. The general nature of the deposits can be seen on the two type logs (plate I) and on the cross section A-A′ (plate VIII). The electrical log of the Richardson and Bass-Amerada No. 1 Brookshire (sec. 5, T12S, R3E) was chosen as the type log for Miocene and Oligocene strata in the northern portion of Abbeville field. The electrical log of the Tennessee Gas No. 1 Detraz (sec. 17, T13S, R3E) was used as a type log for Lower Miocene and Oligo-Miocene strata in the South Perry and Perry areas and in the southern portion of Abbeville field. The Brookshire No. 1 (total depth, 16,020 feet) is one of the deepest tests in Abbeville field. The Detraz No. 1 (total depth, 15,856 feet) is the deepest well in the Perry-South Perry area. The missing section due to faulting in both wells has been restored in the type logs. Important diagnostic faunal markers have been placed on the type logs and on cross section A-A′.

Wells drilled to sufficient depth in the Abbeville-Perry-South Perry area encounter three distinct facies: first, a shallow-water massive Pliocene and Miocene near-shore to continental sand facies; then, an intermediate facies of alternating sands and shales from the Miocene continental shelf; and finally, the thick deep-water shale facies of the early Miocene and late Oligocene continental slope. The interpreted environments of deposition for these facies are based on the lithologic nature of the strata and the paleoecological interpretation of the associated faunas.

Sediments presently being deposited along the Louisiana Gulf Coast consist of sands, near shore; sands and muds farther out on

TABLE 1

Total Accumulated Production Figures for the Abbeville, Perry, and South Perry Fields

Fields	Oil, barrels	Condensate, barrels	Gas, MCF
Abbeville	3,063,218	1,298,248	67,451,671
Perry	None	38,577	6,381,606
South Perry	None	10,694	301,372

the continental shelf; and muds on the continental slope (Lowman, 1949; and Lynch, 1954, p. 79). The change from shelf sands and muds to the muds of the continental slope is abrupt and occurs at the shelf edge (Weaver, 1955). A marked basinward increase in slope and dip of the beds also takes place at the shelf edge. A similar change in facies and dip of strata occurs in Tertiary formations (Lowman, 1949; Limes and Stipe, 1959; and Thorsen, 1964). Thus, lithologies of Tertiary strata can be used to interpret environments of deposition. The abrupt changes from sands and shales to thick shale sections accompanied by steepened dips especially can be used to locate former shelf edges in the Tertiary.

Paleoecological interpretations made in this investigation are based primarily upon the work of Lowman (1949), Crouch (1956a and b), and Skinner (1964, personal communications). Lowman and Crouch list environments of deposition for stratigraphic units containing certain diagnostic Foraminiferida of the Tertiary along the Gulf Coast. Skinner's more recent work was used to verify and supplement the older work of Lowman and Crouch. Paleoecological zones, as defined by Lowman, Crouch, and Skinner, are based primarily upon the ecological study of species that have Recent counterparts. For those species that do not have Recent counterparts, the paleoecological character of the assemblages is inferred by other associated species that do have Recent counterparts.

The oldest strata encountered in the Abbeville-Perry-South Perry area south of fault C belong to the Abbeville Zone which is Oligo-Miocene in age.* The Abbeville is composed almost entirely of shale. A few thin, erratic, shaly-sand bodies are present. The zone represents a deep-water facies deposited on the continental slope. The top of the Abbeville Zone is encountered along the crest of the Abbeville structure at approximately 12,700 feet and in South Perry field at 14,250 feet. Over 1,200 feet of Abbeville strata were drilled in the Brown No. 1 LeBouef (sec. 38, T12S, R3E). This well was still in the Abbeville Zone at the total depth of 14,515 feet.

The oldest beds encountered north of fault C belong to the Anahuac Formation. The Anahuac is Late Oligocene in age and is divisible into three biostratigraphic zones, from youngest to oldest: the *Discorbis, Heterostegina,* and *Marginulina.* The *Marginulina* Zone is a deep-water shale facies deposited in the environment of the continental slope. The only notable sand development in the *Marginulina* Zone is a 80-foot sand body found in the Richardson and Bass-Amerada No. 1 Brookshire at a depth of 15,039 feet. Over 3,500 feet of *Marginulina* strata were encountered in the Union Texas Natural Gas Company No. 1 Hebert (sec. 20, T12S, R3E) at a depth of 15,080 feet. *Marginulina* strata are overlain by 800 to 1,200 feet of *Heterostegina* shales. A few, thin, limy-shale streaks are present. The zone is encountered at depths ranging from 10,800 feet just north of fault C to 12,307 feet on the north flank of Abbeville field. *Heterostegina* strata were deposited in the neritic environment of the continental shelf. The *Heterostegina* Zone is overlain by continental-shelf shales of the *Discorbis* Zone. *Discorbis* strata consist almost entirely of shale, vary from 500 to 700 feet in thickness, and are confined to the northern portion of Abbeville field.

The deepest test in the area, the Sun Oil Company No. 1 Mailbes (sec. 44, T12S, R3E), located on the east flank of the Abbeville structure, penetrated a thick sequence of Anahuac beds. After crossing a fault with a throw of 1,100 feet (fault C) at 11,500 feet, the Mailbes No. 1 drilled through more than 5,000 feet of Anahuac strata between 11,900 feet and the total depth of 17,201 feet.

The Abbeville and Anahuac are overlain by the early Miocene strata of the *Planulina* Zone. North of fault C this zone occurs at depths of about 10,600 feet and varies in thickness from 300 to 700 feet. South of fault C the *Planulina* Zone varies in thickness from 1,100 feet at the crest of the Abbeville structure to nearly 1,300 feet in South Perry field. This zone is encountered south of fault C at depths ranging from

* The age of the Abbeville Zone is controversial. Some workers believe the Abbeville to be (1) post-Anahuac (early Miocene in age), or (2) equivalent to the Anahuac Formation (Oligocene in age). Others, such as Tipsword, (1962, p. 39), consider the Abbeville to be time transgressive and thus Oligo-Miocene in age. In this report the writer follows the suggestion of Tipsword that the Abbeville Zone is Oligo-Miocene in age.

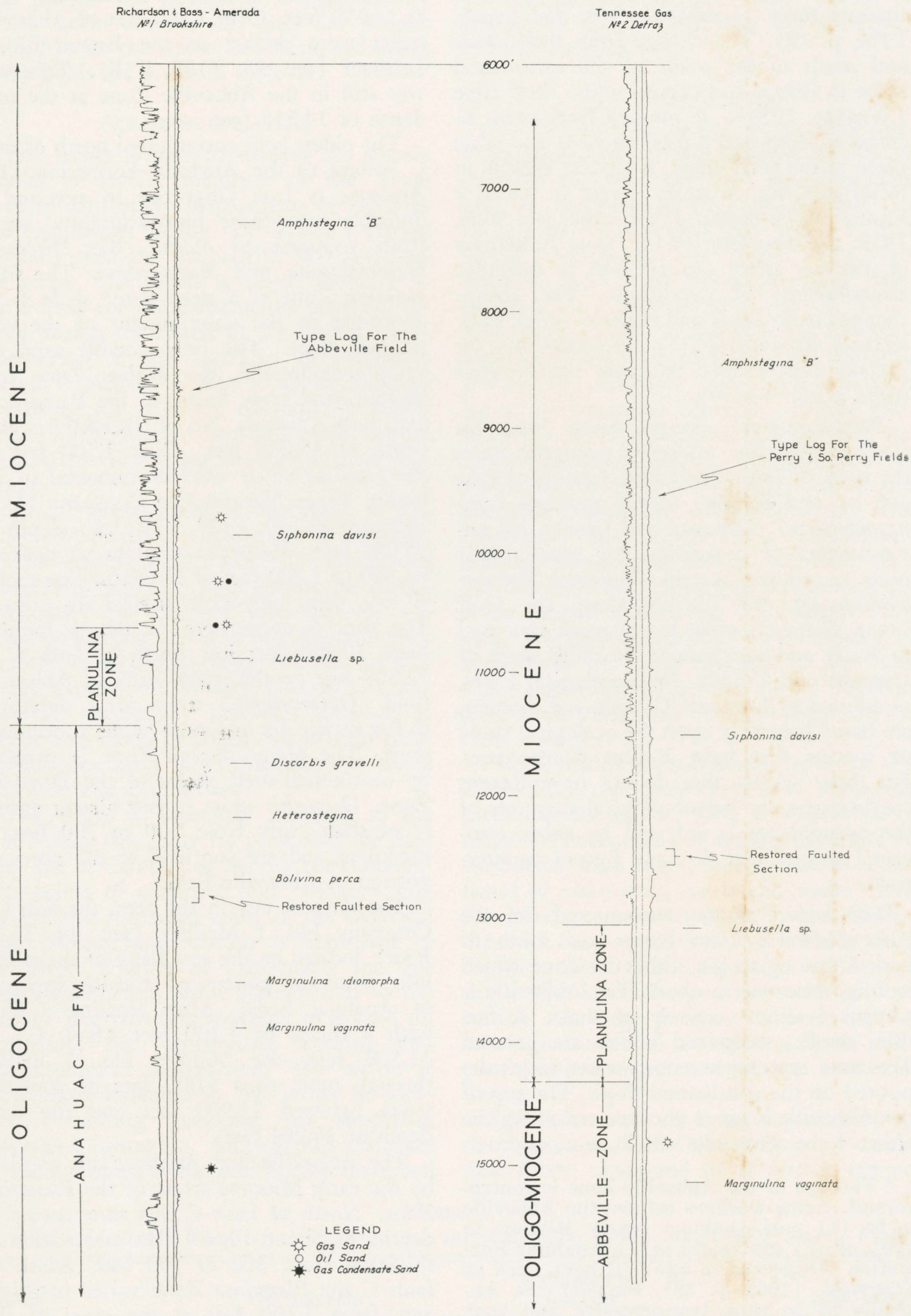


PLATE I

TYPE LOGS FOR THE ABBEVILLE, PERRY AND SOUTH PERRY FIELDS

11,130 feet near this fault to 12,980 feet in South Perry field. Although several persistent sand bodies are present, the zone is predominantly shale. In the Richardson and Bass-Amerada No. 1 Brookshire north of fault C the *Planulina* Zone consists of two 70- to 90-foot sand bodies separated by nearly 300 feet of shale. In South Perry field the zone consists of nearly 1,000 feet of shale and two 50-foot sand bodies at depths of approximately 14,000 feet. The strata of the *Planulina* Zone in the Abbeville-Perry-South Perry area were deposited in the continental-shelf environment.

The *Planulina* Zone is overlain by the Lower Miocene sediments of the *Siphonina davisi* Zone. Approximate thicknesses of this zone are 700 feet at the crest of the Abbeville structure, 800 to 900 feet on the north flank of Abbeville field, and 1,400 feet in the Perry area. The zone is encountered at depths ranging from 9,900 feet to 11,500 feet. The alternating sands and shales of the *Siphonina davisi* Zone are from the continental shelf. Overlying the *Siphonina davisi* Zone are nearly 2,300 feet of Lower Miocene and lower Middle Miocene (*Amphistegina* "B" Zone) massive sands, and alternating sands and shale bodies. These sediments also were deposited on the continental shelf. The *Amphistegina* "B" Zone is overlain by nearly 3,000 feet of massive Miocene sands.

The first occurrence of *Bigenerina floridana* is interpreted as the boundary between the Miocene and the overlying Pliocene. *Bigenerina floridana* occurs at a depth of about 5,000 feet in the Abbeville-Perry-South Perry area. The Pliocene consists of a great thickness of massive sands.

IV. Structure

The Abbeville-Perry-South Perry structure is a faulted, elongate north-northwest trending anticline which extends for nearly nine miles normal to the regional strike of the beds. The average width is between three and four miles. The anticline is cut by numerous normal faults (see plates III to V). The two regional faults shown on the fault map prepared by Wallace (1963) are faults A and C of this report. Both faults are down-to-the-basin and trend east-northeast. All other faults strike either north-northwest (faults, E, G, H, and M) or northeast (faults B and N). The fault-plane dips calculated for the area are: fault A, 63 degrees; fault B, 69 degrees; and faults G and H, 56 degrees. Data related to faults encountered in the Abbeville-Perry-South Perry area have been placed alongside the appropriate well on a composite fault-data map (plate II).

Structural contour maps were prepared on horizons within the Pliocene (plate III) and Miocene (plate IV) and on top of the *Planulina* Zone (plate V). Isopachous maps (plates VI and VII) were constructed for the intervals between the horizons contoured on the structural maps. Cross section A-A′ (plate VIII) is taken along the axis of the Abbeville-Perry-South Perry structure.

The structure map contoured on the 3,200-foot Pliocene sand (plate III) shows a faulted, elongate anticline. Six faults (faults B, C, E, F, G, and H) were mapped on this horizon. The throw of the faults varies from 50 feet to as much as 350 feet. The largest faults (faults B and C) are downthrown to the south or southeast. Areas of closure are mapped on the downthrown side of fault C, the upthrown side of fault H, and along fault B. The amount of closure associated with these structural highs varies from less than 100 feet just southeast of fault B to over 250 feet south of fault C. Other noteworthy features shown on plate III include the graben formed by faults F, G, and H; the strong southward "nosing" of the contours between faults G and H; and the 100 to 150 feet of north dip into fault C.

Plate IV, the structure contour map on the 6,200-foot Miocene sand, also shows the faulted, elongate, anticlinal structure. All the faults mapped at the Pliocene horizon are present also on the map of the Miocene horizon. The faults have increased fault throw at the Miocene horizon in amounts ranging from 50 to 150 feet. For example, the largest faults (faults B and C) have displacements at the Miocene horizon of 450 feet and 500 feet, respectively. Several additional faults (faults A, F, I, and J) were mapped on plate IV. All of these have 60 feet of throw or less. Faults A and F are down-to-the-basin; faults I and J are up-to-the-basin.

Plate IV also illustrates "fault migration" with depth. The largest fault (fault C) is 1,000 to 2,000 feet south of its position at the Pliocene datum. Other faults have shifted approximately 1,800 feet. The crest of the structural high on the downthrown side of fault C also has shifted southward with faults

C and F. The apices of other structural highs (such as the one on the downthrown side of fault B) have remained essentially stationary despite the migration of nearby faults. The southward shift of the apex of the closure on the upthrown side of fault B apparently is not related to the southeastward migration of fault B.

The dip of the beds at the 6,200-foot Miocene horizon is approximately 150 to 200 feet per mile. This represents a 50- to 100-foot per mile increase over the rates of dip observed on the map of the 3,200-foot Pliocene horizon. On plate IV there is shown approximately 100 feet of north dip into fault C and the graben area between faults F, G, and H. The northward dip into fault C is about the same as that in the Pliocene. The graben is narrower (on plate IV) due to the shift of position of faults F, G, and H. On the Miocene horizon the contours "nose" southward in South Perry field and southeastward near the Hunter No. 1 Boudreaux, a wildcat well (sec. 37, T13S, R3E).

Plate V, the structure map contoured on the *Planulina* Zone, shows a narrow, elongate anticline cut by numerous faults. The dip of the beds range from 400 feet per mile to 500 feet per mile which is considerably greater than on the previous map. Most of the faults mapped at the 6,200-foot Miocene horizon also are present in the *Planulina* Zone. The faults increase in throw in amounts ranging from 90 feet to over 500 feet. Most have a throw of about 200 feet. The greatest increase occurs along fault C. It increased from 500 feet at the Miocene horizon to 1,000 feet (on plate V). Faults D, F, J, M, and portions of faults H and G, mapped on the 6,200-foot Miocene horizon are not present in the *Planulina* Zone. Additional faults K, M, and N are mapped on plate V. The displacements on these faults range from 80 to 200 feet. Faults M and N are at Abbeville field, and fault K is present at South Perry field.

Each fault mapped at the 6,200-foot Miocene horizon that extends downward into the *Planulina* Zone has shifted with depth approximately 2,000 feet. The apex of the structural high on the downthrown side of fault C has shifted slightly southward with the southward movement of fault C. Apices of the other structural highs have remained essentially stationary.

Two of the major faults (faults G and H) forming the graben south of fault C extend downward into the *Planulina* Zone. However, fault G, south of fault N, ends abruptly against fault H; and, north of fault N, fault H terminates abruptly against fault G. These abrupt terminations take place in the Lower Miocene section well above the top of the *Planulina* Zone. Thus, the graben as mapped in the Pliocene and Miocene does not occur in the *Planulina* Zone.

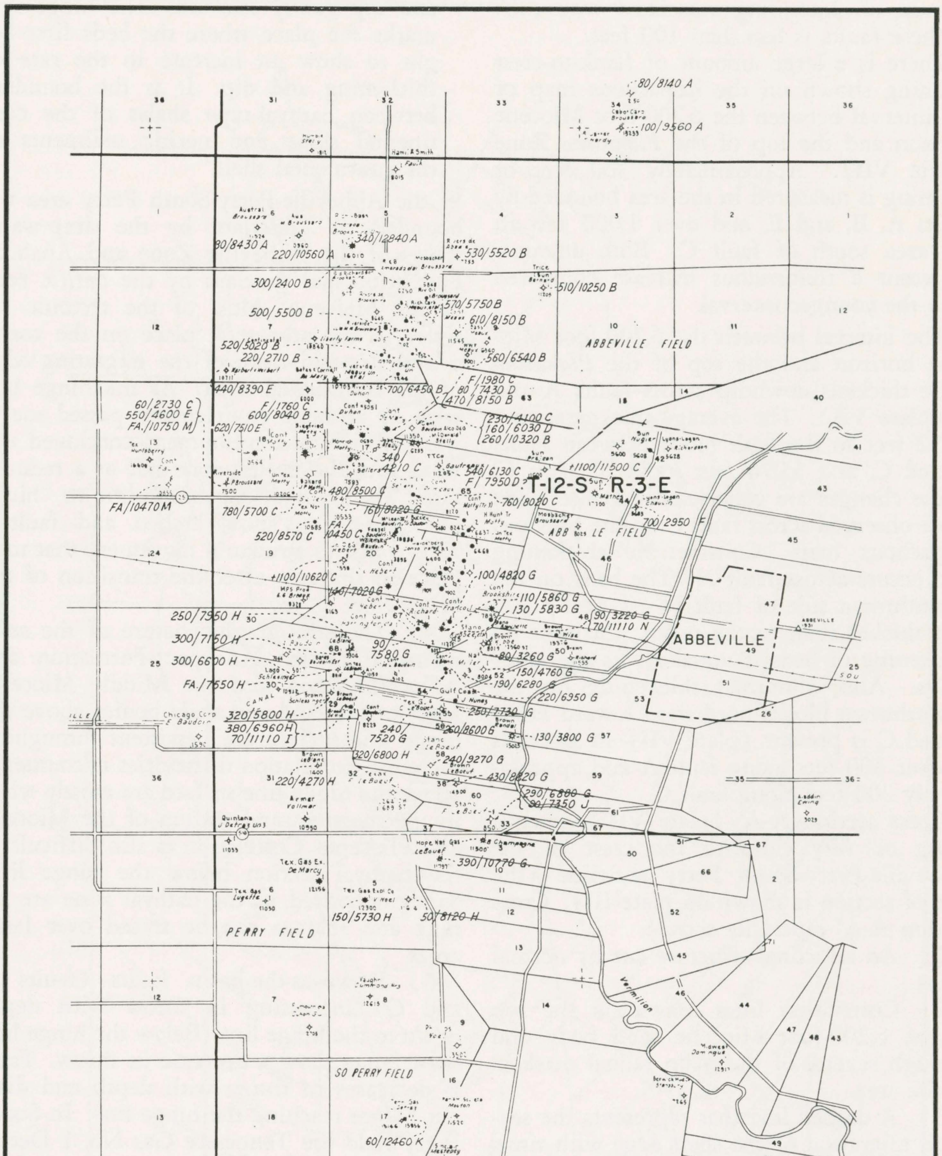
There is a strong southwestward "nosing" of contours in the vicinity of the Hunter No. 1 Boudreaux, a continuation of that noted on the Miocene map. This structural configuration extends toward the Bancker field, located approximately one to two miles south of the Hunter No. 1 Boudreaux. In South Perry field, the slight southward "nosing" of contours is a continuation of that mapped at the Miocene horizon.

Plate VI is an isopachous map of the interval between the 3,200-foot Pliocene and 6,200-foot Miocene mapping horizons. It shows thinning of the beds toward the crest of the Abbeville-Perry-South Perry anticline. Areas of greatest thinning correspond closely to the structurally highest portions of the anticline. An exception occurs on the downthrown side of fault C where the closed area of greatest thinning lies about one mile south-southwest of the apex of the structural high mapped on the Pliocene horizon.

The strata thicken across faults A and C to the south. Average thicknesses are: north of fault A, 2,974 feet; between faults A and C, 3,031 feet; and south of fault C, 3,296 feet. In the fault blocks between faults A and C, and south of fault C the beds are generally thicker on the downthrown sides of the faults. Examples include the 100 feet or more of thickening present on the downthrown side of fault B and in the graben area between faults G and H.

The amount of flank-to-crest thinning between faults A and C is about 140 feet and is generally greater south of fault C. Over 400 feet of thinning is associated with the structural high located between faults F and G. Approximately 170 feet of thinning takes place between faults G and H, and over 200 feet to the west of fault H.

As shown on plate VI, the strata thicken into the downthrown sides of the faults, especially along faults A, B, C, and G. The


ABBEVILLE-PERRY-SOUTH PERRY AREAS
VERMILION PARISH, LA.
FAULT DATA MAP
4000 2000 0 4000
Scale in feet
June 1964
R.O. Steinhoff
T-12-S R-3-E
T-13-S R-3-E
ABBEVILLE FIELD
ABBEVILLE
PERRY FIELD
SO PERRY FIELD
Vermilion
CANAL
80/8140 A
100/9560 A
340/12840 A
80/8430 A
220/10560 A
530/5520 B
300/2400 B
510/10250 B
570/5750 B
500/5500 B
610/8150 B
520/5020 B
220/2710 B
560/6540 B
440/8390 E
700/6450 B
F/1980 C
80/7430 D
470/8150 B
60/2730 C
550/4600 E
FA./10750 M
F/1760 C
600/8040 B
620/7510 E
230/4100 C
160/6030 D
260/10320 B
+1100/11500 C
340
4210 C
540/6130 C
F/7950 D
480/8500 C
760/8020 C
FA/10470 M
780/5700 C
160/8020 G
700/2950 F
520/8570 C
10450 C
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130/5830 G
90/3220 G
70/11110 N
250/7950 H
300/7150 H
90
7580 G
80/3260 G
300/6600 H
150/4760 G
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FA./7550 H
220/6950 G
320/5800 H
250/1730 G
380/6960 H
70/11110 I
260/8600 G
240
7520 G
130/3800 G
320/6800 H
240/9270 G
220/4270 H
430/8820 G
290/6880 G
90/7350 J
390/10770 G
150/5730 H
50/8120 H
60/12460 K
80/13100 K

PLATE II

amount of thickening associated with each of these faults is less than 100 feet.

There is a large amount of flank-to-crest thinning shown on the isopachous map of the interval between the 6,200-foot Miocene horizon and the top of the *Planulina* Zone (plate VII). Approximately 360 feet of thinning is measured in the area bounded by faults A, B, and F, and over 1,000 feet in the area south of fault C. Both amounts represent a tremendous increase compared with the younger interval.

The interval between the 6,200-foot Miocene horizon and the top of the *Planulina* Zone thickens downdip across faults A and C (plate VII). The average thicknesses are 4,452 feet in the fault block between faults A and C, and 5,076 feet south of fault C. These changes are considerably greater than those observed across fault C on the previous isopachous map. Considerable thickening also occurs across fault N. The beds on the downthrown side of fault N are nearly 200 feet thicker than to the north. Little or no thickening of beds is noted across the other faults. Also, abnormal thickening on the downthrown blocks northward toward faults A and C is present (plate VII) in amounts of over 300 feet along fault A and approximately 200 feet along fault C.

Cross section A-A′ (plate VIII) extends along or very close to the crest of the Abbeville-Perry-South Perry anticline (the line of section is shown on plate III). Cross section A-A′ especially shows:

1) An anticlinal structure cut by normal faults.

2) Correlation lines drawn on the top of the 6,200-foot Miocene sand body and through several of the main faunal markers in the area.

3) A dashed line that represents the seaward migration of the shelf edge with time. The shelf edge is termed a "hinge line" by many Gulf Coast geologists including Weaver (1955), Hardin and Hardin (1961, p. 244), Skinner (1963, personal communication), and Steinhoff (1964). Steinhoff (1964, p. 164) states:

> "A hinge line in Gulf Coast terminology is a tectonic zone of weakness downdip from which the sedimentary beds thicken abnormally basinward. The thickening is accompanied by a sharp increase in the rate of southward dip. Updip from the zone are shelf sediments which thicken and dip gently seaward. The hinge line marks the place where the beds first begin to show an increase in the rate of thickening and dip. It is the boundary between bathyal-type shales of the continental slope and neritic sediments of the continental shelf."

In the Abbeville-Perry-South Perry area the boundary is underlain by the deep-water shales of the Abbeville Zone and Anahuac Formation and overlain by the neritic beds of the Miocene. Most of the tectonic activity in the area took place on the continental slope in front of the migrating edge of the continental shelf. As the hinge line with its unstable environment passed southward, structural development continued upward into the neritic zone but at a reduced rate. The trace of the hinge line or "hinge line surface" is now arched and faulted. This is due to structural movement that took place in the area after the transition of the hinge line.

4) The stratigraphic nature of the sediments from the Anahuac Formation and Abbeville Zone into the Middle Miocene. Most of the sand and shale bodies above the hinge line surface are persistent throughout the area. Correlation difficulties encountered above the hinge line surface are mostly within the massive sand section of the Miocene and Pliocene. Correlation is also difficult in the bathyal section below the hinge line. Sands deposited in the bathyal zone are erratic and seldom can be traced over large areas.

5) Down-to-the-basin faults (faults A and C) increasing in throw with depth down to the hinge line. Below the hinge line both faults show a decrease in throw. Fault B decreases in throw with depth and dies-out before reaching the hinge line. In South Perry field the Tennessee Gas No. 1 Detraz is cut by a small down-to-the-southwest fault that terminates in the Miocene strata. Faults C and H form a graben in the vicinity of the Brown No. 1 LeBoeuf. The peculiar configuration of fault H on cross section A-A′ is due to the direction of the line of section. Fault G is actually down-to-the-west but it has the appearance on plate VIII of being down-to-the-south. Fault G "dies out" in the deep-water shales of the Oligocene.

6) Thinning of beds over the crest of the structure and thickening of strata on the downthrown sides of fault A and C. The

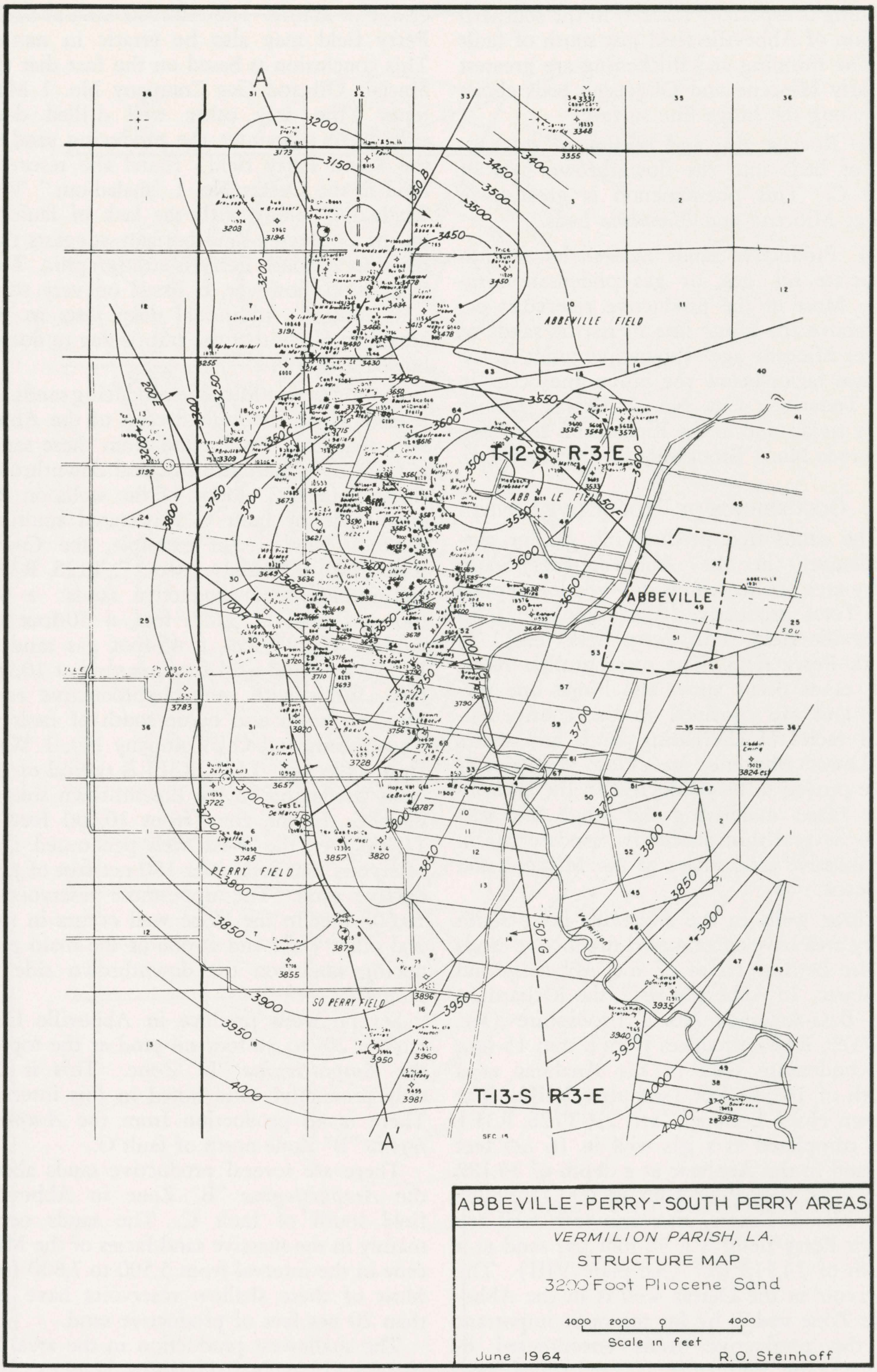
A
A'
T-12-S R-3-E
T-13-S R-3-E
ABBEVILLE FIELD
ABBEVILLE
PERRY FIELD
SO PERRY FIELD
ABBEVILLE-PERRY-SOUTH PERRY AREAS
VERMILION PARISH, L.A.
STRUCTURE MAP
3200 Foot Pliocene Sand
4000 2000 0 4000
Scale in feet
June 1964
R.O. Steinhoff

PLATE III

thinning is especially marked in the southern portion of Abbeville field just south of fault C. The thinning and thickening are greatest in early Miocene and Oligocene beds above and along the hinge line surface.

7) Reverse dip and northward thickening of beds into the downthrown side of fault C. This phenomenon is greatest in Lower Miocene and *Planulina* beds.

8) Productive sands marked by the appropriate oil, gas, or gas-condensate symbols. Most of the productive reservoirs occur above the hinge line in neritic sands of Lower Miocene age. Productive sands in the bathyal facies below the hinge line occur in the Tennessee Gas No. 1 Detraz (South Perry field) and in the Richardson and Bass-Amerada No. 1 Brookshire (Abbeville field).

V. Occurrence of Productive Sands

The sands that produce oil, gas, or gas-condensate in the Abbeville-Perry-South Perry area are shown on the type logs (plate I). Total productive sands number 16 in Abbeville field, 3 in Perry field, and 1 in South Perry field. The most prolific reservoir sands occur above the hinge line surface and are confined to the continental-shelf facies of alternating sands and shales of Lower Miocene age. Only three sands have proven to be productive in the bathyal-type facies underlying the hinge line surface. Several thin productive sands occur in the massive sand facies of the Miocene and Pliocene.

Three wells in the Abbeville-Perry-South Perry area have encountered productive sands in the bathyal facies of the Abbeville and Anahuac. In Abbeville field, the Richardson and Bass-Amerada No. 1 Brookshire (sec. 8, T12S, R3E) produces from a thin 15-foot gas-condensate sand in the Anahuac at a depth of 14,980 feet (see plate VIII). The Brown No. 1 LeBouef (sec. 29, T12S, R3E) was completed as a gas well in 16 net feet of sand in the Anahuac at a depth of 13,182 feet. The producing sand in the Tennessee Gas No. 1 Detraz, the discovery well for South Perry field, is a 36-foot gas sand at a depth of 14,712 feet (see plate VIII). The reservoir in the Detraz well is in the Abbeville Zone and is by far the most important of the productive sands encountered in bathyal-type sediments. The bathyal productive sands in Abbeville field are thin and erratic in nature. The reservoir sand in South Perry field may also be erratic in nature. This conclusion is based on the fact that the Sinclair Oil and Gas Company No. 1 Mestepey (the only other well drilled deep enough to encounter the producing sand in the South Perry field) found the reservoir sand in the Detraz No. 1 "shaled-out." This "shale-out," along with the lack of faulting on the producing-sand horizon, suggests that the trap at South Perry is stratigraphic. This suggestion, however, is based on very scant well control. Additional deep tests in the area may prove that the trap is due to deeply buried faulting.

Prolific Lower Miocene producing sands are present along the faulted crest of the Abbeville structure. Production from these sands is from both the upthrown and downthrown sides of fault C. Many of the wells on the north side of fault C penetrated multiple reservoir sands. For example, the Continental No. 1 DeMary (sec. 17, T12S, R3E) encountered four productive sands: a 65-foot gas sand at 9,628 feet, a 30-foot oil sand at 10,294 feet, a 45-foot gas sand at 10,512 feet, and a 23-foot gas sand at 10,583 feet. Wells with multiple-productive early Miocene sands also occur south of fault C. The Continental Oil Company No. 1 Wise Unit 4 (sec. 67, T12S, R3E) is typical of the wells producing on the downthrown side of fault C. In the zone from 10,600 feet to 11,300 feet, the Wise well penetrated four reservoirs that total over 180 net feet of productive sand. The uppermost reservoir at 10,608 feet in the Wise well occurs in several other wells and is one of the main producing sands on the downthrown side of fault C.

Several wells produce in Abbeville field from a 20- to 30-foot oil sand at the top of the *Amphistegina* "B" Zone. This is the only productive sand noted in this interval. There is no production from the *Amphistegina* "B" Zone north of fault C.

There are several productive sands above the *Amphistegina* "B" Zone in Abbeville field south of fault C. The sands occur mainly in the massive sand facies of the Miocene in the interval from 5,500 to 7,800 feet. Most of these shallow reservoirs have less than 20 net feet of productive sand.

The shallowest production in the area occurs in Abbeville field in the MacLean No. 1 Baudoin (sec. 20, T12S, R3E). Produc-

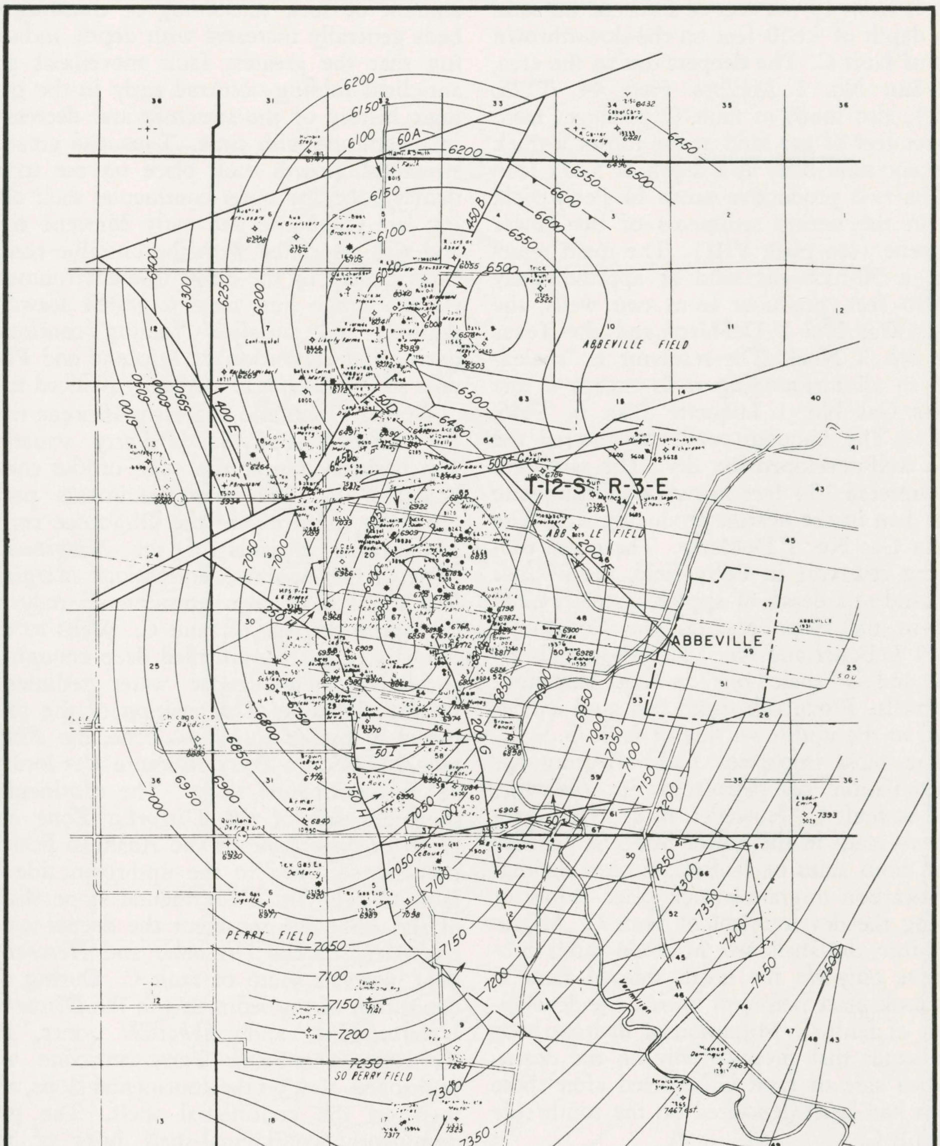
ABBEVILLE-PERRY-SOUTH PERRY AREAS
VERMILION PARISH, LA
STRUCTURE MAP
6200 Foot Miocene Sand
4000 2000 0 4000
Scale in feet
June 1964
R.O. Steinhoff
T-12-S R-3-E
T-13-S R-3-E
ABBEVILLE
ABBEVILLE FIELD
PERRY FIELD
SO PERRY FIELD

PLATE IV

tion is from 10 net feet of Pliocene oil sand at a depth of 3,850 feet on the downthrown side of fault C. The deepest test in the area, the Sun No. 1 Mailbes (sec. 44, T12S, R3E), also south of fault C, produces from 28 net feet of gas sand at the top of a thick Miocene sand body at a depth of 5,472 feet.

The two productive sands in Perry field are in the neritic sediments of the Lower Miocene (see plate VIII). The main reservoir, a 50-foot gas sand at approximately 10,900 feet, produces from two wells, the Texas Gas No. 1 DeMarcy and the Texas Gas No. 1 Noel. The reservoir is "shaled-out" in all surrounding wells except in the Texas Gas No. 1 Luquette (sec. 6, T13S, R3E). The Luquette well encountered the sand well-developed but dry. The sand was encountered 154 feet lower in the Luquette well than in the nearest producing well, The Texas Gas No. 1 DeMarcy. The other producing reservoir in Perry field, the 20-foot gas sand at a depth of approximately 11,200 feet in the Hope Natural Gas Company's No. 1 LeBouef and No. 1 Champagne, is erratic and is "shaled-out" in most surrounding wells. Production from this sand is confined to the upthrown side of fault G.

The most important fault affecting the accumulation of petroleum in Abbeville field is fault C. However, most of the productive sands in the Lower Miocene produce from both sides of fault C, suggesting that hydrocarbon migration took place before or during the development of fault C. Migration into the shallower Miocene sands productive only on the north side of fault C also took place before or during the development of fault C. Migration of hydrocarbons into sands that produce only on the downthrown side of fault C occurred after these sands had been deposited on the south side of fault C.

VI. Structural Growth and Geologic History

Thickening of beds onto the downthrown sides of faults and thinning of strata along the crest and over the structurally highest portions of the Abbeville-Perry-South Perry anticline were observed on all of the isopachous maps. These phenomena indicate that fault movement and anticlinal folding were contemporaneous with sedimentation and acted more or less continuously from the Oligocene into the Pliocene Epoch. The amount of such thickening or thinning of beds generally increases with depth, indicating that the greatest fault movement and anticlinal folding occurred early in the geologic history of the structure and decreased in magnitude with time. Thus, the greatest structural growth took place on the continental slope and outer continental shelf during late Oligocene and early Miocene time and was associated with the unstable conditions created by the hinge line environment. As the hinge line zone migrated seaward, faulting and anticlinal folding continued during the deposition of Miocene and Pliocene sediments but at a steadily reduced rate.

During Oligocene and early Miocene time the Abbeville-Perry-South Perry structure was positioned near the edge of the continental shelf. The oldest sediments penetrated by the drill are the Oligocene continental-slope deposits of the *Marginulina* Zone of the Anahuac Formation. *Marginulina* strata have been encountered only on the upthrown side of fault C. Wells to the south have not been drilled deep enough to encounter these deeper water sediments. During the time of deposition of the sediments in the *Marginulina* Zone, the Abbeville-Perry-South Perry structure was located on the continental slope. The continental-shelf deposits of the *Discorbis* Zone and *Heterostegina* Zone of the Anahuac Formation are confined to the upthrown side of fault C. The thick continental slope shales of the Abbeville represent the deeper-water equivalent of the *Discorbis* and *Heterostegina* intervals south of fault C. During the deposition of the sediments in the *Discorbis, Heterostegina,* and *Abbeville* zones, the Abbeville-Perry-South Perry anticline was positioned, first on the continental slope, and then on the continental shelf. The predominantly continental-shelf beds of the *Planulina* Zone (early Miocene) were deposited across both sides of fault C. The basal portion of the *Planulina* Zone south of fault C probably represents continental slope deposition. Thus, during the deposition of the *Planulina* Zone, the Abbeville-Perry-South Perry structure was situated near the shelf edge on the continental slope and later entirely on the continental shelf.

As the hinge line migrated seaward, the Abbeville-Perry-South Perry structure became positioned progressively closer to the shoreline. During Miocene time the

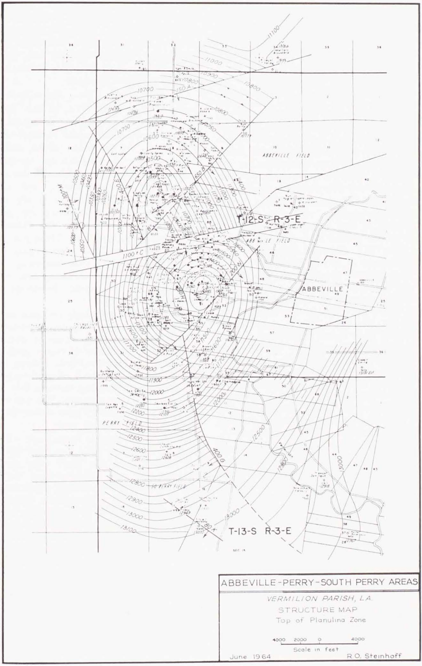
T-12-S R-3-E
ABBEVILLE
ABBEVILLE FIELD
PERRY FIELD
T-13-S R-3-E
ABBEVILLE-PERRY-SOUTH PERRY AREAS
VERMILION PARISH, LA.
STRUCTURE MAP
Top of Planulina Zone
4000 2000 0 4000
Scale in feet
June 1964
R.O. Steinhoff

PLATE V

structure was located first, on the outer continental shelf, then on the intermediate continental shelf, and later on the inner continental shelf. During Pliocene time the structure was located in a near-shore or continental environment.

Fault C played a dominating role in the structural development of the Abbeville-Perry-South Perry structure. Continued movement along fault C, especially in late Oligocene and early Miocene time, kept the area south of fault C structurally lower than the area to the north, allowing greater thicknesses of sediments to accumulate on the downthrown side. The equivalent sediments on the upthrown side are much thinner.

Movement along faults F, G, and H also was contemporaneous with sedimentation. Thickening of beds is especially prominent in the graben formed by faults F, H, and G (see plate VI). Although fault F and portions of faults B and H developed during the deposition of the Anahuac, the graben did not begin to form until early Miocene time. Movement along faults A and B generally took place after the deposition of the sediments. No noticeable change in thickness across fault A can be detected in beds of Miocene and Pliocene age. Since there is no deep-well control north of fault A, the amount of thickening (if it does occur) of the Anahuac across fault A is not known. The lack of thickening onto the downthrown side of fault B on plate VII suggests that fault B originated after the Anahuac and Lower Miocene beds had been deposited.

Comparison of the various structural maps shows that the Abbeville-Perry-South Perry structure increases in sharpness with depth. In fact, the anticline mapped on the deepest mapping horizon (top of the *Planulina* Zone) is quite narrow. The structure could not continue to increase in sharpness through thousands of feet of sediments to some deep-seated origin. The writer believes that this structure had its beginning with anticlinal folding and faulting that originated on the continental slope near the shelf edge during late Oligocene time.

VII. Summary and Conclusions

(1) Strata in the Abbeville, Perry, and South Perry fields range from Pliocene to Oligocene in age. Wells drilled to sufficient depth in these fields encounter three distinct facies: first, a shallow-water massive Pliocene and Miocene near-shore to continental sand facies; then, an intermediate facies of alternating sand and shales from the Miocene continental shelf; and, finally, the thick deep-water shale facies of the early Miocene and late Oligocene.

(2) Structurally, the Abbeville-Perry-South Perry feature is a faulted, north-northwest trending anticline elongated for several miles normal to the regional strike of the beds. All faults are normal and include both down-to-the-basin and up-to-the-south faults. The main faults are down-to-the-basin, regional in nature, and trend parallel to the regional strike of the beds. The smaller faults are compensating up-to-the-south faults confined to the Abbeville-Perry-South Perry structure. The throw generally increases gradually with depth. The several faults with throw decreasing with depth appear to "die-out" in the deep-water shale facies of the Anahuac Formation and the Abbeville Zone.

(3) Beds are thin along the crest of the structure and thicken on the downthrown sides of the faults. The amount of thinning or thickening generally increases gradually with depth. Thus, anticlinal folding and fault movement occurred contemporaneous with sedimentation, acted more or less continuously from Oligocene into Pliocene time, and were greatest in intensity during Oligocene and Lower Miocene time.

(4) The Abbeville-Perry-South Perry structure originated with anticlinal folding and faulting near the shelf edge during Oligocene and early Miocene time. As the hinge line migrated basinward, the structure became positioned progressively closer to the shoreline until, in Pliocene time, it was near the shoreline. Anticlinal folding and fault activity were greatest when the structure was located near the shelf edge. Structural activity steadily decreased as the hinge line with its unstable environment continued to migrate southward.

(5) The most prolific reservoir sands are in the continental-shelf facies of alternating sands and shales. The few productive sands that occur in the bathyal facies are thin and erratic. Producing intervals encountered in the massive sand facies are generally thin and relatively unimportant.

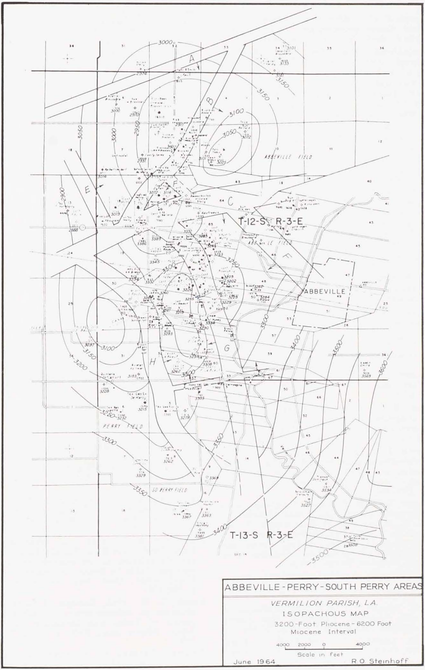
ABBEVILLE-PERRY-SOUTH PERRY AREAS
VERMILION PARISH, LA.
ISOPACHOUS MAP
3200-Foot Pliocene - 6200 Foot
Miocene Interval
4000 2000 0 4000
Scale in feet
June 1964
R.O. Steinhoff
T-12-S R-3-E
T-13-S R-3-E
ABBEVILLE
ABBEVILLE FIELD
PERRY FIELD
SO PERRY FIELD

PLATE VI

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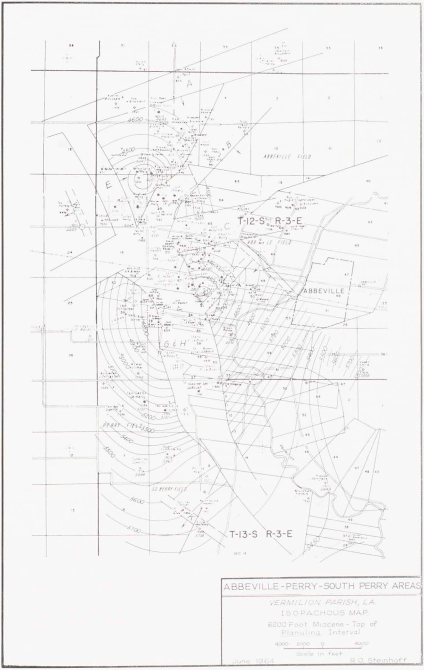
ABBEVILLE FIELD
T-12-S R-3-E
ABBEVILLE
PERRY FIELD
SO PERRY FIELD
T-13-S R-3-E
ABBEVILLE-PERRY-SOUTH PERRY AREAS
VERMILION PARISH, LA.
ISOPACHOUS MAP
6200 Foot Miocene - Top of Planulina Interval
4000 2000 0 4000
Scale in feet
June 1964
R.O. Steinhoff

PLATE VII

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ERRATA

VOLUME 2 (1963-1964)

NO. 3—pages 104 and 106. The scales at the bottom of figures 1 and 2 were inadvertently omitted by the engraver. The complete corrected figures are reproduced below. (continued on page 148)

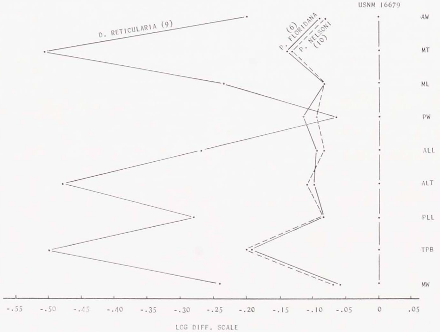

Figure 1. Ratio diagram of dimensions of nuchal bone in several turtles, as labeled. USNM 16679 is the holotype of *D. floridana*. Numbers in parenthesis refer to number of specimens. A W = width of anterior border, M T = maximum midline thickness, M L = median length, P W = width of posterior border, A L L = length of anterolateral border, A L T = thickness of anterolateral border, P L L = length of posterolateral border, T P B = thickness of posterior border, M W = maximum width.